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ELECTROCHEMICAL AND TRANSPORT STUDIES IN HIGHLY ORDERED
SOLVENT SYSTEMS(U) CORNELL UNIV ITHACA NY DEPT OF
CHEMISTRY H D ABRUNA 06 AUG 86 N00014-84-K-0656

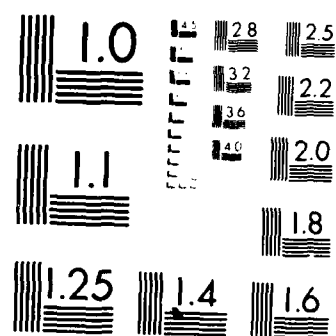
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MICROCOPY RESOLUTION TEST CHART
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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Electrochemical and Transport Studies in Highly Ordered Solvent Systems		5. TYPE OF REPORT & PERIOD COVERED Final 8-15-84 -- 8-15-86
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) H.D. Abruna		8. CONTRACT OR GRANT NUMBER(s) N00014-84-K-0656
9. PERFORMING ORGANIZATION NAME AND ADDRESS Department of Chemistry Cornell University Ithaca, New York 14853		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS NR 627-844
11. CONTROLLING OFFICE NAME AND ADDRESS Office of Naval Research 800 N. Quincy Street Arlington, VA 22217		12. REPORT DATE August 6, 1986
		13. NUMBER OF PAGES 3
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) This document has been approved for public release and sale; its distribution is unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Liquid crystals, electrochemistry, polyvinylferrocene		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)		

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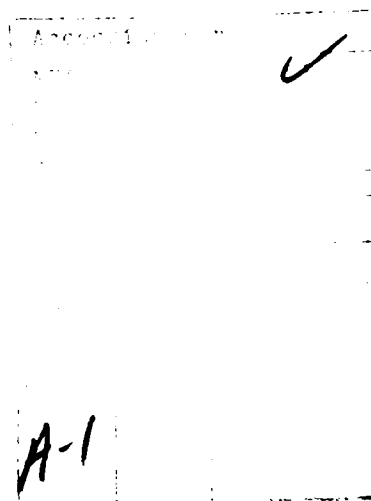
The electrochemical characterization of three room temperature nematic phase liquid crystals has been performed in order to determine the utility of these materials as solvents for electrochemical studies. In acetonitrile and in the neat phase, MBBA (p-methoxy benzilidene-p'-butyl aniline), MBAB (methoxy-butyl azoxybenzene), and K15 (p-pentyl-p'-cyano biphenyl) show a wide range of potentials for electrochemical experiments. Large IR drops for MBBA and MBAB in the neat phase precluded their use while K15 was very well-behaved by comparison.

K15 was nonetheless a resistive electrochemical solvent. Maintaining a low electrolyte concentration (35 mM TBAP (tetra n-butyl ammonium perchlorate)) to ensure the presence of the nematic phase requires the use of semi-microelectrodes (1×10^{-3} cm² Pt disk) to mitigate IR drops in the system. The electrochemical response of several redox compounds in K15 differs substantially from the observed response in acetonitrile. By way of comparison to the response of tetramethylbenzidine in tetrahydrofuran, these differences largely result from ion-aggregate formation.

Attempts to achieve a monodomain in the electrochemical cell demonstrate some degree of order at the electrode/solution interface. Peak-current measurements for the isotropic and oriented (parallel or perpendicular) mesophase are the criteria. These results are preliminary in that the effects of the electrode/cell-boundary spacing and electrode potential have not been addressed. Additionally, the formal potential for tetracyanoethylene and its radical anion appear to be sensitive to the orientation of the nematic with respect to the electrode. Any emphasis on a formal potential/orientation relationship must be cautioned because the stability and solution chemistry of the radical anion are not fully characterized.

Incorporation of K15 into electrodeposited films of polyvinylferrocene substantially alters the rate of charge transport through the film. Especially noteworthy is the temperature dependence of these films above and below the nematic/isotropic transition temperature. Changes in the peak

currents and formal potential as a function of K15 concentration indicate an expected viscosity dependence and the presence of K15/ferrocene aggregates. In certain cases, two electrochemically non-equivalent ferrocene sites are evident by the splitting of the ferrocene wave.



Technical Reports

1. Electrochemical Studies in Liquid Crystals
2. Electrochemistry in Liquid Crystals: Orientational Effects in Orientational Processes
3. Transport Properties of Liquid Crystal Doped Films of Polyvinylferrocene
4. Electrochemistry in Liquid Crystals

Publications:

1. A.M. Serra, R.D. Mariani, H.D. Abruña. Electrochemistry in Liquid Crystals: Orientational Effects in Electrochemical Processes. J. Electrochem. Soc. (accepted).
2. R.D. Mariani, H.D. Abruña. Transport Properties of Liquid Crystal Doped Films of Polyvinylferrocene Electrochim. Acta (submitted).
3. A.M. Serra, R.D. Mariani, H.D. Abruña. Electrochemistry in Liquid Crystals Proc. 7th Int. Electroanal. Symp. pp. 126-131. BAS Press 1986.

Personnel Involved:

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